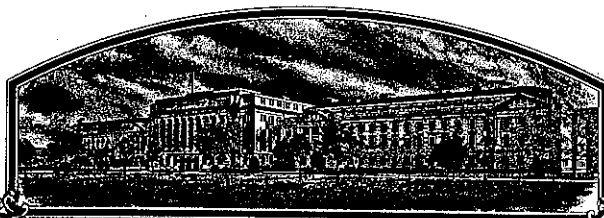


No.

8600113



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME;

Sharpe's International Seeds Limited

Whereas, THERE HAS BEEN PRESENTED TO THE
Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF *eighteen* YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS CLAIMED, CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Camargue'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D. C. this 30th day of September in the year of our Lord one thousand nine hundred and ninety-one.

Attest

Kenneth H. Evans

Commissioner

Plant Variety Protection Office
Agricultural Marketing Service

Ed Madison
Secretary of Agriculture

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

FORM APPROVED: OMB NO. 0581-0055

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions on reverse)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) BOOKER SEEDS LIMITED HURST GUNSON COOPER TABER LIMITED SHARPES INTERNATIONAL SEEDS LIMITED		2. TEMPORARY DESIGNATION NONE		3. VARIETY NAME CAMARGUE	
4. ADDRESS (Street and No. or R.F.D. No., City, State, and Zip Code) Hurst Crop Research and Development Unit Gt. Domsey Farm, BOSTON ROAD, SLEAFORD Feering, COLCHESTER, Essex.		5. PHONE (Include area code) 0529-304511 0376-71123		FOR OFFICIAL USE ONLY PVPO NUMBER 8600113	
6. GENUS AND SPECIES NAME HORDEUM VULGARE		7. FAMILY NAME (Botanical) GRAMINAE		FILING DATE May 2, 1986 TIME 10:00 <input checked="" type="checkbox"/> A.M. <input type="checkbox"/> P.M.	
8. KIND NAME SPRING BARLEY		9. DATE OF DETERMINATION 1986		FEE RECEIVED AMOUNT FOR FILING \$ 1800. DATE May 2, 1986 AMOUNT FOR CERTIFICATE \$ 200. ⁰⁰ DATE September 11, 1991	
10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION (Corporation, partnership, association, etc.) LIMITED COMPANY				11. IF INCORPORATED, GIVE STATE OF INCORPORATION NOT APPLICABLE	
12. DATE OF INCORPORATION					
13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS					

PHONE (Include area code):

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED	
a. <input checked="" type="checkbox"/> Exhibit A, Origin and Breeding History of the Variety (See Section 52 of the Plant Variety Protection Act.) b. <input checked="" type="checkbox"/> Exhibit B, Novelty Statement. c. <input checked="" type="checkbox"/> Exhibit C, Objective Description of Variety (Request form from Plant Variety Protection Office.) d. <input checked="" type="checkbox"/> Exhibit D, Additional Description of Variety. e. <input checked="" type="checkbox"/> Exhibit E, Statement of the Basis of Applicant's Ownership.	
15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? (See Section 83(a) of the Plant Variety Protection Act.) <input checked="" type="checkbox"/> Yes (If "Yes," answer items 16 and 17 below) <input type="checkbox"/> No	
16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED? <input type="checkbox"/> Foundation <input checked="" type="checkbox"/> Registered <input checked="" type="checkbox"/> Certified
18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.? <input type="checkbox"/> Yes (If "Yes," give date) <input checked="" type="checkbox"/> No	
19. HAS THE VARIETY BEEN RELEASED, OFFERED FOR SALE, OR MARKED IN THE U.S. OR OTHER COUNTRIES? NATIONAL LISTED IN U.K. DECEMBER 1984 OFFERED FOR SALE IN U.K. 1986 <input checked="" type="checkbox"/> Yes (If "Yes," give names of countries and dates) <input type="checkbox"/> No	
20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable. The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act. Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.	

SIGNATURE OF APPLICANT

DATE

23rd April 1986

SIGNATURE OF APPLICANT

DATE

23rd April 1986

CAMARGUEEXHIBIT A

Pedigree: 49428/69 (Diamant x 14029/64/6) x KM 1192

Camargue was bred using the traditional pedigree method. The variety has been stable and uniform over several generations.

EXHIBIT B

Camargue is a medium height, two row, mid season Spring Barley of high yield, disease resistance, thousand grain weight and malting quality.

Camargue is most similar to Triumph, Camargue differs from Triumph in mildew resistance, straw length, hordein composition and malting quality. Please see data below for straw length, Hordein composition and malting quality.

Straw length - cms

mean of 10 trials

Triumph	80.37
Camargue	74.44
Coefficient of variation	3.485%
Least significant difference (5%)	2.55

Hordein composition

Classified according to their pattern of D and C hordeins and then sub-divided according to their B hordein pattern.

Triumph is in the two groups - 10.2 and 10.3

Camargue is in group 6.2

Malting quality

Results from 15 trials over two years.

Hot Water extract	L ^o /kg
Triumph	303.68
Camargue	296.68
Coefficient of variation	1.139%
Least significant difference (5%)	2.57

NIAB

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY

HUNTINGDON ROAD CAMBRIDGE CB3 0LE

PATRON: HER MAJESTY THE QUEEN

Telephone: Cambridge (0223) 276381

Telex: 817455 NIAB G

Fax: (0223) 277602

Mr F Bassi
Sharps International
Sleaford
Lincolnshire
NG34 7HA

20 June 1991

Dear Mr Bassi

SPECIFIC RESISTANCE TO MILDEW IN CORNICHE, CAMARGUE AND TRIUMPH

I have been asked by Dr Bayles to send you information about the resistance genes and techniques used to determine the resistance genes in the spring barley varieties Corniche, Camargue and Triumph.

RESISTANCE GENES

The resistance alleles and genes in the three varieties are:

Corniche <i>Mla12</i> , <i>Ml(Ab)</i>	(BMR5, 6c)
Camargue <i>Mla13</i> , <i>Ml(Ab)</i>	(BMR10?, 6c)
Triumph <i>Mla7</i> , <i>Ml(Ab)</i>	(BMR6b, 6c)

The designations for the resistance alleles or genes are those used throughout Europe. The barley mildew resistance (BMR) factor designations are those used in the UK by the United Kingdom Cereal Pathogen Virulence Survey. The information has been published: J K M Brown and J H Jorgensen, A Catalogue of Mildew Resistance Genes in European Barley Varieties, In Integrated Control of Cereal Mildews: Virulence Patterns and their Change, edited by J H Jorgensen, published by Cisp National Laboratory, Roskilde.

TECHNIQUES

Corniche was first listed by NIAB in 1986, and Triumph in 1980. Camargue was first listed by the Scottish Agricultural College in 1986.

Tests are carried out on detached leaves, incubated on 0.5% water agar containing 100ppm benzimidazole. The detached leaves are inoculated with mildew spores in a settling tower. The tests are incubated at 15°C with 16 hours of light in each 24 hour period for about 10 days.

DIFFERENTIAL VARIETIES

The differential varieties currently used are:

Golden Promise	None	(BMR0)
Astrix	<i>Mlh, Mlra</i>	(BMR1a,1b)
Zephyr	<i>Mlg, Ml(CP)</i>	(BMR2a,2b)
Midas	<i>Mla6</i>	(BMR3)
Lofa Abed	<i>Ml(La)</i>	(BMR4)
Hassan	<i>Mla12</i>	(BMR5)
Hordeum 1063	<i>Mlk</i>	(BMR6a)
Porter	<i>Mla7</i>	(BMR6b)
Triumph	<i>Mla7, Ml(Ab)</i>	(BMR6b,6c)
Natasha	<i>Mla12, Ml(Ab)</i>	(BMR5,6c)
Tyra	<i>Mla1</i>	(BMR7)
Simon	<i>Mla9, Mlk</i>	(BMR8)
Apex	<i>mlo</i>	(BMR9)
Digger	<i>Mla13</i>	(BMR10a)
Sherpa	<i>Mla13 +?</i>	(BMR10b,+?)
Camargue	<i>Mla13, Ml(Ab)</i>	(BMR6c,10?)

You will see that Camargue and Triumph are listed as differential varieties. This is because they were the first commercial varieties with those combinations of resistance genes.

DIFFERENTIAL ISOLATES

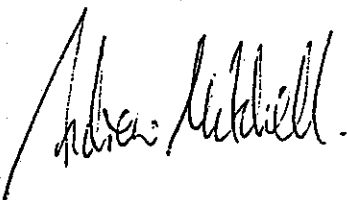
The differential isolates currently used are:

CC66	BMV2,3,4,6a,6c,8
CC93b	BMV2,3,5,6c,7
CC107	BMV2,6a,6b,6c,8
CC99	BMV2,4,5,6b,6c
CC137	BMV2,4,5,6a,6b,7
CC133	BMV2,3,6a,6b,6c,10
CC201	BMV2,4,5,6a,6b,10
CC79	BMV2,5,6a,6b,6c

The barley mildew virulence factors correspond to the resistance gene and allele designations.

I also enclose a copy of the 1990 UKCPVS report for Mildew of Barley. I hope this provides you with the information you require.

Yours sincerely



Dr A G MITCHELL
CEREAL PATHOLOGY SECTION

MILDEW OF BARLEY

A. G. Mitchell and S. E. Slater

NIAB, Huntingdon Road, Cambridge

The frequencies of barley powdery mildew virulence factors corresponding to the race-specific resistances used in barley cultivars in Britain continued to be high for the resistances which are most widely utilised (BMR 1, 2, 5, 6a, 6b and 6c), and static or increasing for those more recently introduced or less widely utilised (BMR 4, 7, 8 and 10). There was no evidence of increased virulence for BMR 9 (*mlo*), which continues to provide effective resistance. The most frequent virulence phenotypes were complex, with about 70% of isolates carrying 5 or more virulence factors.

INTRODUCTION

The barley powdery mildew surveys in 1988 and 1989 (Slater *et al.* 1989, Brown *et al.* 1990) indicated that the resistance genes currently used in commercial cultivars of barley in the UK do not in general provide effective resistance to the disease. The exception was barley mildew resistance factor 9 (BMR 9), controlled by allele *mlo*.

The 1990 survey continued with the aims of:

1. Monitoring changes in the frequencies of virulences matching the mildew resistances in currently grown cultivars.
2. Determining the specific resistances in new cultivars and estimating the frequencies of common combinations of virulences for the compilation of variety diversification schemes.

Work for the barley powdery mildew survey moved to NIAB, Cambridge in 1990, and virulence testing began in July. This was too late in the season for the receipt of infected barley leaves from UKCPVS participants. The 1990 survey was carried out using samples from variety trials plots and on single colony isolates from seedlings of Golden Promise exposed on a high roof at NIAB. The source of the isolates is therefore limited, and not necessarily representative of the barley powdery mildew population in Britain.

METHODS

Isolates were derived from samples of infected leaves taken in July from variety trials plots at three sites; NIAB, Cambridge (116 isolates), Headley Hall, West Yorkshire (13 isolates), and Dunmow, Essex (19 isolates). Several samples were taken from the same cultivar at each site, making in effect only 19 samples from different cultivars at different sites. The source cultivars were; Annie (MMG 8817/5, BMRx), Blenheim,

Corniche and Prisma (BMR5,6c), Chad and Decor (BMR6c,7?), Digger (BMR10a), Hart (BMR9), Heritage (BMR10?), Klaxon (BMR4,6a,6b), Nomad (BMR4?,8), Nugget and Tyne (BMR4?,10?), Shirley (BMR4,5), Target (BMR1), and Triumph (BMR6b,6c).

Single colony isolates were taken from seedlings of Golden Promise, exposed on a high roof at NIAB, Cambridge in July and October (roof isolates). A total of 100 isolates was tested from each of these months.

All isolates were tested for virulence on the detached leaves of the differential cultivars listed in Table 1. These cultivars carry the resistances known to have been used in barley cultivars grown in the UK. However, Astrix (BMR1a,1b) did not differentiate BMV 1a from 1b, and Zephyr (BMR2a,2b) did not differentiate BMV 2a and 2b. The frequencies of these virulence factors have been very high in previous years (Slater *et al.* 1989, Brown *et al.* 1990). Virulence was determined according to the infection types of Moseman *et al.* 1965.

Table 1. *Differential cultivars used for determining virulence factors in isolates of barley powdery mildew in 1990.*

BMR Group	European code*	Resistance gene	Cultivar
0			Golden Promise
1a, 1b	Ha, Ra	<i>Mlh</i> , <i>Mlra</i>	Astrix
2a, 2b	We	<i>Mlg</i> , <i>Ml(CP)</i>	Zephyr
3	Sp	<i>Mla6</i>	Midas
4	La	<i>Ml(La)</i>	Lofa Abed
5	Ar	<i>Mla12</i>	Hassan
6a	Kw	<i>Mlk</i>	Hordeum 1063
6b	Ly	<i>Mla7</i>	Porter
6b, 6c	Ly, Ab	<i>Mla7</i> , <i>Ml(Ab)</i>	Triumph
5, 6c	Ar, Ab	<i>Mla12</i> , <i>Ml(Ab)</i>	Natasha
7	Al	<i>Mla1</i>	Tyra
6a, 8	Kw, MC	<i>Mla9</i>	Simon
9	Mlo	<i>mlo</i>	Apex
10a	Ru	<i>Mla13</i>	Digger
10b + ?	Ru, ?	<i>Mla13</i> , ?	Sherpa
6c, 10	Ab, Ru	<i>Ml(Ab)</i> , <i>Mla13</i>	Camargue

* Jørgensen, 1987

RESULTS

Virulence Frequencies

The frequencies of BMV 1, 2, 3, 4, 5, 6a, 6b, 6c, 7, 8 and 10 amongst the leaf and roof isolates are given in Table 2. For the leaf sample, the frequencies have been expressed in two ways; in the first, all virulences from all isolates have been included irrespective of the source cultivar, and in the second, the virulences from each isolate matching the resistances of its source cultivar have been excluded. That is, only

unnecessary virulences have been considered. Since the resistance factors in Annie are not known, isolates from this cultivar have been excluded from the second presentation.

Considering only unnecessary virulences reduces the selective influence of host resistance on the frequencies of the virulence factors in the leaf sample. This is probably more representative of the mildew population in the areas from which leaf samples were taken. The frequencies of BMV 4, 5, 6c, 7, 8 and 10 are lower when only unnecessary virulences are considered, indicating selection for these virulences by the host cultivars.

BMV 3, 4, 7, 8 and 10 occurred at frequencies of about 20% in most of the samples, and the corresponding resistances may still have some effectiveness. BMV 1, 2, 5, 6a and 6b were all found at high frequencies. None of the isolates were virulent on Apex (BMR 9), including 7 isolates from Hart (BMR 9).

The limited source of the samples used in the 1990 survey means that changes from previous years in the frequencies of particular virulence factors must be viewed with caution. The frequencies of BMV 1, 2, 6a, 6b, 7 and 8 showed little change from 1989. BMV 3 may have declined slightly, probably because of the absence of BMR 3 from current cultivars (Slater et al. 1989). BMV 4 and 5 were also recorded at lower frequencies in 1990, but since cultivars with BMR 4 and 5 are widely grown at present this may be sampling error. BMV 10 showed an increase, corresponding to the increased acreage of Pipkin.

Table 2. *Frequency of virulence factors in isolates from infected leaves (leaf sample), and in random samples of single colony isolates formed by airborne spores (roof samples).*

Virulence factor	Frequency of virulence factors (%)			
	Leaf sample, July 1990		Roof sample July 1990	Roof sample Oct. 1990
	All data	Unnecessary* virulence		
1	64	72		
2	94	88		
3	10	11	16	17
4	39	14	22	20
5	63	41	60	59
6a	80	67	69	64
6b	61	54	79	68
6c	60	21	65	66
7	25	14	6	5
8	22	14	9	17
10	44	12	17	33
Number of isolates	146	136	100	100

* Includes virulence factors only where they were unnecessary for virulence on the host cultivar.

Complexity of Isolates

Table 3 shows the number of virulence factors carried by the mildew isolates. Most isolates were complex, with at least 69% of them in each sample carrying 5 or more virulence factors.

Table 3. Number of virulence factors (BMV 1, 2, 3, 4, 5, 6a, 6b, 6c, 7, 8 and 10) carried by isolates of barley mildew.

No. of BMV factors	Frequency of isolates (%)		
	Leaf sample July 1990	Roof sample July 1990	Roof sample Oct. 1990
0	0	0	1
1	1	1	2
2	0	0	2
3	4	16	7
4	9	12	14
5	25	25	28
6	29	33	30
7	29	11	14
8	3	2	1
9	0	0	0
10	0	0	0
11	0	0	0
No. of isolates tested	146	100	100

Frequencies of Virulence Phenotypes

The frequencies of the most common virulence phenotypes defined by BMV 1, 2, 3, 4, 5, 6a, 6b, 6c, 7, 8 and 10 in the leaf and roof samples are shown in Table 4. These common phenotypes represented about 45% of the total number of isolates in each sample, with the remaining phenotypes recorded only once or twice.

The frequencies of particular phenotypes varied between the two types of sample. Phenotypes BMV1,6b,6c, BMV1,2,5,6b,6c, and BMV1,2,5,6a,6b,6c were the commonest phenotypes in the roof samples, but were relatively infrequent in the leaf sample. The most frequent phenotype in the leaf sample, BMV 1,2,6a,6b,6c,8,10 was relatively infrequent in the roof samples.

Several of the most frequent phenotypes were those with the greatest number of virulence factors. The commonest phenotype in the leaf sample (BMV1,2,6a,6b,6c,8,10) was also the most common in 1988 and 1989 (Slater et al. 1989, Brown et al. 1990). Most of the common phenotypes are virulent on cultivars in more than one diversification group, but the phenotype BMV1,2,4,5,6a,6b,6c,8,10, detected for the first time last year (Brown et al. 1990) and avirulent only on cultivars with BMR 3 or 7, was found in only one isolate.

Table 4. Frequencies of the most common barley mildew virulence phenotypes, defined by BMV 1, 2, 3, 4, 5, 6a, 6b, 6c, 7, 8 and 10.

BMV phenotype	Frequency of virulence phenotype (%)		
	Leaf sample	Roof sample	Roof sample
	July 1990	July 1990	Oct. 1990
2, 5, 6a, 6c	6	0	0
1, 2, 5, 6a, 6c	4	2	0
1, 2, 4, 5, 6a, 6c	6	2	3
1, 6b, 6c	0	11	2
1, 2, 5, 6b, 6c	1	5	8
1, 2, 5, 6a, 6b, 6c	2	18	8
2, 5, 6b, 6c, 7	5	0	0
1, 2, 4, 5, 6a, 6b, 10	6	0	0
1, 2, 6a, 6b, 6c, 10	6	4	5
1, 2, 6a, 6b, 8, 10	3	1	8
1, 2, 6a, 6b, 6c, 8, 10	12	2	3
Total no. of phenotypes	58	51	50
No. of isolates tested	146	100	100

The complexity of the common virulence phenotypes increases the difficulty of maintaining a practical variety diversification scheme for barley. The following virulence combinations which match the resistances in two diversification groups (in addition to group 0) were recorded at high frequencies:

BMR 2, 4	and BMR 5	(Diversification groups 3 and 5)
BMR 6b, 6c	and BMR 8	(Diversification groups 6 and 8)
BMR 6b, 6c	and BMR 10	(Diversification groups 6 and 4)
BMR 8	and BMR 10	(Diversification groups 8 and 4)

Given the limited source of the isolates used in this year's survey, these data are an inadequate basis for recommendations of changes to the diversification scheme. A high risk of the spread of mildew between cultivars in diversification groups 4 and 8 is already indicated.

Resistance Factors in New Cultivars

The resistance factors in cultivars currently included in the barley mildew variety diversification scheme are given in Table 5.

Heritage was originally thought to have BMR 9 because of its parentage, but the results of detached leaf tests to determine the virulence of isolates from Heritage suggested that it has BMR 10. Further tests using differential mildew isolates confirmed this.

Additional tests on Shirley suggest that it has BMR4,5.

Table 5. Mildew resistance factors of cultivars in the Barley Mildew Diversification Scheme.

BMR 0		BMR 8		BMR 4,6b	
Clarine	(W)	Manitou	(W)	Doublet	(S)
Gaulois	(W)	Poacher	(W)		
Halcyon	(W)			BMR 4,6a,6b	
Maya	(W)	BMR 9		Klaxon	(S)
Pastoral	(W)	Alexis	(S)		
Paris	(W)	Atem	(S)	BMR 4,6a,7	
Plaisant	(W)	Hart	(S)	Regatta	(S)
Posaune	(W)	Redstart ?	(S)		
Shire	(W)			BMR 5,6c	
Sprite	(W)	BMR 10		Blenheim	(S)
Target	(W)	Pipkin	(W)	Corniche	(S)
G. Promise	(S)	Digger	(S)	Natasha	(S)
		Heritage ?	(S)	Prisma	(S)
BMR 1		Sherpa (+?)	(S)		
Finesse	(W)	Tyne (+4?)	(S)	BMR 6b,6c	
Igri	(W)			Triumph	(S)
		BMR 1,2,3			
BMR 2		Kira	(W)	BMR 6c,7?	
Fighter	(W)	Torrent	(W)	Chad	(S)
Frolic	(W)			Decor	(S)
Gypsy	(W)	BMR 1,2,5			
Magie	(W)	Puffin	(W)	BMR 6c, 8	
Melusine	(W)			Nomad	(S)
Mimosa	(W)	BMR 2,4			
Panda	(W)	Golf	(S)	BMR 6c,10	
				Camargue	(S)
BMR 2,6b		BMR 4,5			
Volga	(S)	Shirley	(S)	UNKNOWN	
				Annie	(S)
BMR 5		BMR 4,6a		Forester	(S)
Sarah	(W)	Oboe	(S)	Nugget (4?,10?)	(S)
Waveney	(W)				
BMR 6b					
Marinka	(W)				

(W) winter barley, (S) spring barley

CONCLUSIONS

The results of the 1990 barley powdery mildew survey follow the trends identified in previous years. That is:

1. High frequencies of virulence factors matching specific resistances which have been used for a number of years in barley cultivars grown in Britain.
2. Increasing frequencies of virulence factors matching more recently introduced resistance factors.
3. Increasing complexity of the barley powdery mildew population.

BMR 3, 4, 7, 8 and 10 may still have some effectiveness in controlling mildew, particularly combinations of BMR 4 (*Ml(La)*) with BMR 3, 7, 8 or 10 (*Mla6*, *Mla1*, *Mla9* and *Mla13* respectively). However, it is very likely that the mildew population will adapt rapidly to any new combinations. BMR 9 remains effective in Britain.

REFERENCES

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Jørgensen, J.H. (1987) Joint proposal 2: designations of barley powdery mildew resistance and virulence in Europe. In: *Integrated Control of Cereal Mildews: Monitoring the Pathogen* pp 1-3, ed. M.S. Wolfe and E. Limpert, pub. Martinus Nijhoff Publishers, Dordrecht.

Moseman, J.G., R.C.F. Macer and L.W. Greeley (1965) Genetic studies with cultures of *Erysiphe graminis* f.sp. *hordei* virulent on *Hordeum spontaneum*. Transactions of the British Mycological Society 48, 479-489.

Slater, S.E., J.K.M. Brown, M.S. Wolfe, P.N. Minchin and H.N. Rezanoor (1989) Mildew of barley. U.K. Cereal Pathogen Virulence Survey: 1988 Annual Report, 22-29.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK, POULTRY, GRAIN & SEED DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Barley)

OBJECTIVE DESCRIPTION OF VARIETY
BARLEY (*HORDEUM VULGARE*)

INSTRUCTIONS: See Reverse.

NAME OF APPLICANT(S) SHARPES INTERNATIONAL SEEDS LIMITED	FOR OFFICIAL USE ONLY
HURST GUNSON COOPER TABER LIMITED BOOKER SEEDS LIMITED	PVPO NUMBER 8600113
ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code) HURST Crop Research and Development Unit, Gt. Domsey Farm, Feering, COLCHESTER. Essex.	VARIETY NAME OR TEMPORARY DESIGNATION CAMARGUE

Place the appropriate number that describes the varietal character of this variety in the boxes below.

Place a zero in first box (i.e. or) when number is either 99 or less or 9 or less.

1. GROWTH HABIT:

1 = SPRING 2 = FACULTATIVE WINTER 3 = WINTER Early Growth: 1 = PROSTRATE 2 = SEMIPROSTRATE
3 = ERECT

2. MATURITY (50% Flowering):

1 = EARLY (California Mariout) 2 = MIDSEASON (Betzes) 3 = LATE (Frontier)

No. of days Earlier than } 1 = BETZES 2 = CALIFORNIA MARIOUT 3 = CONQUEST 4 = DICKSON
 No. of days Later than } 5 = PIROLINE 6 = PRIMUS 7 = UNITAN

3. PLANT HEIGHT (From soil level to top of head):

1 = SEMIDWARF 2 = SHORT (California Mariout) 3 = MEDIUM TALL (Betzes) 4 = TALL (Conquest)

Cm. Shorter than } 1 = BETZES 2 = CALIFORNIA MARIOUT 3 = CONQUEST 4 = DICKSON
 Cm. Taller than } 5 = PIROLINE 6 = PRIMUS 7 = UNITAN

4. STEM:

Exertion (Flag to spike at maturity): 1 = 0 - 3 cm. 2 = 3 - 10 cm. Anthocyanin: 1 = ABSENT 2 = PRESENT
3 = 10 - 15 cm.

NO. OF NODES (Originating from node above ground)

Collar Shape: 1 = CLOSED 2 = V-SHAPED 3 = OPEN Shape of Neck: 1 = STRAIGHT 2 = SNAKY
4 = MODIFIED CLOSED OR OPEN 3 = OTHER (Specify) _____

5. LEAF:

Basal leaf sheath (seedling): 1 = GLABROUS 2 = PUBESCENT Position of flag leaf (at boot stage): 1 = DROOPING
2 = UPRIGHT

Waxiness: 1 = ABSENT (Glossy) 2 = SLIGHTLY WAXY MM. WIDTH (First leaf below flag leaf)
3 = WAXY

CM. LENGTH (First leaf below flag leaf) Anthocyanin in leaf sheath: 1 = ABSENT 2 = PRESENT

6. HEAD:

Type: 1 = TWO-ROWED 2 = SIX-ROWED Density: 1 = LAX 2 = ERECT (Not dense)
3 = ERECT (Dense)

Shape: 1 = TAPERING 2 = STRAP 3 = CLAVATE Waxiness: 1 = ABSENT (Glossy) 2 = SLIGHTLY WAXY
4 = OTHER (Specify) _____ 3 = WAXY

Lateral Kernels Overlap: 1 = NONE 2 = AT TIP Rachis (Hair on edge): 1 = LACKING 2 = FEW 3 = COVERED
3 = 1/4 - 1/2 OF HEAD

7. GLUME:

Length: 1 = 1/3 OF LEMMA 2 = 1/2 OF LEMMA Hairs: 1 = NONE 2 = SHORT 3 = LONG
3 = MORE THAN 1/2 OF LEMMA

Hair covering: 1 = NONE 2 = RESTRICTED TO MIDDLE 3 = CONFINED TO BAND 4 = COMPLETELY COVERED

Awns: 1 = LESS THAN EQUAL TO LENGTH OF GLUMES 2 = EQUAL TO LENGTH OF GLUMES
3 = MORE THAN EQUAL TO LENGTH OF GLUMES

Awn Surface: 1 = SMOOTH 2 = SEMISMOOTH 3 = ROUGH

8. LEMMA:

☐ 5 Awn: 1 = AWNLESS 2 = AWNLETS ON CENTRAL ROWS, AWNLESS ON LATERAL ROWS
 3 = SHORT ON CENTRAL ROWS, AWNLETS ON LATERAL ROWS 4 = SHORT (less than equal to length of spike)
 5 = LONG (longer than spike) 6 = HOODED

☐ 3 Awn Surface: 0 = AWNLESS 1 = SMOOTH 2 = SEMISMOOTH 3 = ROUGH

☐ 2 Teeth: 1 = ABSENT 2 = FEW 3 = NUMEROUS ☐ 1 Hair: 1 = ABSENT 2 = PRESENT

☐ 1 Shape of base: 1 = DEPRESSION 2 = SLIGHT CREASE ☐ 2 Rachilla Hairs: 1 = SHORT 2 = LONG
 3 = TRANSVERSE CREASE

9. STIGMA:

☐ 2 Hairs: 1 = FEW 2 = MANY

10. SEED:

☐ 2 Type: 1 = NAKED 2 = COVERED ☐ 1 Hairs on Ventral Furrow: 1 = ABSENT 2 = PRESENT

☐ 4 Length: 1 = SHORT (8.0 mm.) 2 = SHORT TO MIDLONG (7.5 - 9.0 mm.) 3 = MIDLONG (8.5 - 9.5 mm.)
 4 = MIDLONG TO LONG (9.0 - 10.5 mm.) 5 = LONG (10.0 mm.)

☐ 3 Wrinkling of hull: 1 = NAKED 2 = SLIGHTLY WRINKLED 3 = SEMIWRINKLED 4 = WRINKLED

☐ 1 Aleurone Color: 1 = COLORLESS (White or Yellow) 2 = BLUE

☐ 0 0 PERCENT ABORTIVE ☐ 4 5 GMS. PER 1000 SEEDS

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

<input type="checkbox"/> 0 SEPTORIA	<input type="checkbox"/> 0 NET BLOTCH	<input type="checkbox"/> 0 SPOT BLOTCH	<input type="checkbox"/> 2 POWDERY MILDEW ^{AMS} RVPO
<input type="checkbox"/> 1 LOOSE SMUT	<input type="checkbox"/> 0 BACTERIAL BLIGHT	<input type="checkbox"/> 0 COVERED SMUT	<input type="checkbox"/> 0 FALSE LOOSE SMUT
<input type="checkbox"/> 0 STEM RUST	<input type="checkbox"/> 2 LEAF RUST	<input type="checkbox"/> 0 SCAB	<input type="checkbox"/> 0 SCALD
<input type="checkbox"/> 0 AY	<input type="checkbox"/> 0 BSMV	<input type="checkbox"/> 0 BYDV	<input type="checkbox"/> 2 OTHER (Specify) PUCCINIA STRIIFORMIS

12. INSECT: (0 = Not tested, 1 = Susceptible, 2 = Resistant)

<input type="checkbox"/> GREEN BUG	<input type="checkbox"/> ENGLISH GRAIN APHID	<input type="checkbox"/> CHINCH BUG	<input type="checkbox"/> ARMYWORM
<input type="checkbox"/> GRASS HOPPERS	<input type="checkbox"/> CEREAL LEAF BEETLE	<input type="checkbox"/> OTHER (Specify) _____	
HESSIAN FLY RACES	<input type="checkbox"/> GP	<input type="checkbox"/> A	<input type="checkbox"/> B
	<input type="checkbox"/> D	<input type="checkbox"/> E	<input type="checkbox"/> F
			<input type="checkbox"/> C
			<input type="checkbox"/> G

13. CHEMICAL (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

☐ DDT ☐ OTHER (Specify) _____

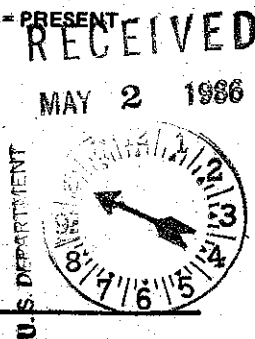
14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	TRIUMPH	Seed size	TRIUMPH
Leaf size	TRIUMPH	Coleoptile elongation	TRIUMPH
Leaf color	TRIUMPH	Seedling pigmentation	TRIUMPH
Leaf carriage	TRIUMPH		

REFERENCES: The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

1. Wiebe, G. A., and D. A. Reid, 1961, Classification of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Dept. of Agriculture.
2. Reid, D. A., and G. A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Dept. of Agriculture. pp. 61 - 84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.



CAMARGUE**Origin**

49428/69 (Diamant x 14029/64/6) x Km 1192

Breeders Designation

VSB 60741/76

Ear**General**

- Two-row, narrow, parallel, long, density lax to medium; sterile spikelets divergent, length medium-long to long, rounded to pointed at tips; awns rough, often twice ear length

Collar**Rachis**

- Platform to shallow cup
- First segment, medium to medium-long, width medium-wide occasionally wide, margin hairs moderate to numerous. Segments in mid-third, long, weekly "humped" in profile.

Grain**General**

- Size medium, oval, skin finely wrinkled; antho-cyanin pigment in lemma nerves at maturity weak.

Base of lemma**Rachilla**

- Bevelled
- Length medium to medium-long occasionally long; hair type long; hairs at apex short-medium to medium.

Spicules**Ventral furrow****Lodicules**

- 1 to 5 on inner lateral nerves.
- Glabrous
- 'Collar' type, short to intermediate.

Field Characters

At tillering, habit of growth variable, semi-prostrate to semi-erect; leaf length short-medium, width medium; leaf sheaths glabrous, pigment weak to occasionally strong.

At shooting, leaf attitude semi-erect.

At earing, flag length and width medium, attitude horizontal to deflexed; auricle pigment strong to very strong.

After earing, ear glaucosity medium-strong to strong, sheath and culm glaucosity medium to medium-strong; awn tip pigment medium to medium-strong; neck length negative occasionally short

At maturity, ears pendulous

Reaction to DDT - Susceptible.

8600113

EXHIBIT E

~~BOOKER SEEDS~~ SHARPES INTERNATIONAL SEEDS

Camargue is owned by ~~Hurst Gimson Cooper Taber~~ Limited.

5/10/60
25 9/10/61

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8600113

CERTIFICATE OF INCORPORATION
ON CHANGE OF NAME

No. 24499

I hereby certify that

HURST GUNSON COOPER TABER LIMITED

having by special resolution changed its name, is now
incorporated under the name of
BOOKER SEEDS LIMITED

Given under my hand at the Companies Registration Office,
Cardiff the 1ST JANUARY 1987

MRS. E. J. JONES

Certified to be a true copy

an authorised officer

Company Secretary

8600113



CERTIFICATE OF INCORPORATION ON CHANGE OF NAME

No. 24499

I hereby certify that

BOOKER SEEDS LIMITED

having by special resolution changed its name,

is now incorporated under the name of

SHARPES INTERNATIONAL SEEDS LIMITED

Given under my hand at the Companies Registration Office,

Cardiff the 20 MAY 1991

M. Rose

M. ROSE

an authorised officer